

# **Development of the Clean Cities Model in Manila, the Philippines**

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## Country Background<sup>1</sup>

The Philippines is an island nation of 81.2 million people located in Southeast Asia. The total land area of the Philippines is 115,830 sq. mi. (slightly larger than the U.S. State of Arizona). The capital is Manila which is also the largest city. The President is Gloria Macapagal Arroyo who was sworn in January 20th, 2001, after the resignation of Joseph Estrada. The next presidential election is in May 2004.

### Energy

The Philippines are highly dependent on outside sources of energy. The government has created the Philippine Energy Plan 2000-2009 (PEP) with the following as major goals: 1. Increase energy sufficiency from 42% in 2000 to 49% in 2004, 2. accelerate completion of the "O Ilaw" rural electrification program to be completed by 2004, 3. implement structural reforms to increase private-sector investment so as to meet projected energy requirements in electricity, 4. create a policy framework for the natural gas industry, and 5. continue to deregulate the downstream oil sector. (See Appendix A for a summary of the Philippine Energy Plan 2000-2009.)

### Oil

In 2000, the Philippines produced 4,000 barrels per day (bbl/d) and consumed 377,000 bbl/d, resulting in net imports of 373,000 bbl/d. This dependence on imported oil makes the Philippine economy vulnerable to sudden spikes in world oil prices. For example, the Philippines oil import bill increased over 70% during the first eight months of 2000. Oil consumption is expected to increase over the next several years, as economic growth increases demand in most sectors, but oil demand for power generation will diminish as a result of the government's drive to retire aging oil-fired electric power plants and switch to alternative power sources.

The Philippines oil market was deregulated in 1998, and long term investments totaling almost \$250 million have flowed into the country as a result, with more expected. There is an effort in the legislature to repeal the deregulation. Opponents see it as insufficient, because new players have not been able to capture at least 30% of the market. In January 2000, the Philippines Department of Energy announced plans to accelerate the phasing out of leaded gasoline, with leaded gasoline presently already banned in Manila.

### Natural Gas

The Philippines has 2.8 trillion cubic feet (Tcf) of proven natural gas reserves. While in the past the gas sector has not been developed extensively, the government has made expanding gas use a priority, particularly for electric power generation, to cut oil import expenses. The Philippines

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<sup>1</sup> Energy Information Administration Country briefs, [www.eia.doe.gov](http://www.eia.doe.gov).

government expects total gas production to reach 146.6 billion cubic feet (Bcf) in 2004 and 255.8 Bcf in 2009.

The Philippine government is developing a policy framework for the emerging gas industry. They foresee the government's role to be facilitating and ensuring competition. While domestic development will be encouraged, competition from imported gas will be allowed. Gas supply to wholesale markets will have market-set prices, while prices for captive markets and small consumers will be regulated.

## Coal

Coal is the Philippines largest source of fossil energy production, at 1.1 million short tons (Mmst) in 1999. Coal production increased in 2000, though a majority of total coal consumption continues to come from imports. Several new mines are expected to enter production in the next few years.

## Electricity

Energy production in the Philippines is concentrated in the electricity sector. Geothermal power accounts for the country's largest share of indigenous energy production, followed by hydropower, coal, and oil and gas. The Philippine government has made shifting from reliance on imported oil a major goal, and is pushing the current boom in natural gas-fired electricity development.

Electricity demand is expected to grow almost 9% per year until 2009, necessitating almost 10,000 megawatts (MW) of new installed electric capacity. Current contracts will provide about half of that amount, with the remainder expected to be filled once the market deregulates.

The Philippines, due to its geography, has problems linking all of its islands together into one grid and ensuring availability of electric power to the remaining 9,708 villages without electricity. The government has set a target date of 2004 for electrification of all these villages through the 14-billion peso "O-Ilaw" program, and also is taking steps to link together the country's three major power grids (Luzon, Visayas, and Mindanao). Where it is not economical to link small islands' grids into the national grid, separate local systems are being established around small generating plants.

## Renewables

The Philippines is the world's second largest producer of geothermal power, with currently available capacity of 1,900 MW, according to the Philippine government. The country is located in the volcanically active "Ring of Fire." Geothermal power currently makes up around 16% of the Philippines installed generation capacity, most of which has been developed by the Philippine National Oil Company - Energy Development Corporation (PNOC-EDC).

The Philippines is also exploring the use of other renewables for electricity generation, with government plans to use solar, wind, or micro-hydro power in half of the country's unelectrified villages. In December 2000, WorldWater Corp. signed an agreement with Cebu Electric Cooperative to provide 1,200 homes with solar electrification. In March 2001, the Philippine and Spanish governments and BP Amoco signed a \$48 million contract to bring solar power to 150 villages. The United States Department of Energy wind mapping survey estimates that wind resources in the Philippines have a power generation potential of as much as 70,000 MW. A biomass waste-to-energy plant is planned for Negros Occidental that would use 450 tons of municipal waste and bagasse per hour.

## Nuclear

In March 2000 the government announced that it would build a 600-MW nuclear power plant similar to the Bataan plant by 2020. However, the Bataan plant was declared inoperable due to its location on an earthquake fault, and the government continues to pay \$250,000 per day to service the debt on the inoperable plant. The Triga Research Reactor, which dates from 1963, is to be replaced with a new 20-MW research reactor, according to the Philippine government.

## **Experience with the Clean Cities Model in Cities in the Developing World**

Clean Cities has experience with establishing the Clean Cities model in several countries including Mexico, Brazil, Chile, India, China, Peru, and Bangladesh. Of these, establishment of the Santiago, Chile Clean Cities provides many pertinent insights into how to approach establishing a Clean Cities in Manila. Chile has virtually no oil resources, but Argentina has abundant natural gas. A pipeline was built from Argentina to Chile which made using natural gas as a fuel viable in Santiago. Santiago relies heavily on buses for public transport (about 9,000 in all) and suffers from their emissions, which are exacerbated by frequent atmospheric inversions. Several steps were taken to initiate use of natural gas in bus transportation in Santiago:

1. A scoping mission was sent from the U.S. to Santiago to assess the capability of establishing natural gas buses.
2. A local Clean Cities Coordinator was hired who planned a seminar to launch the program and publicize the need for natural gas buses.
3. An environmental study was completed which quantified the benefits of using natural gas in transit buses.
4. A reverse trade mission was completed which educated Chilean officials and bus owners about natural gas bus technology, safety, and training requirements.
5. Several natural gas buses were placed in service along with about 700 natural gas light duty vehicles. These vehicles are providing sufficient demand for expansion of natural gas refueling facilities to serve additional vehicles.

The use of natural gas as a clean transportation fuel has been initiated in Santiago, Chile through

the efforts of the Clean Cities coordinator and stakeholders. Significant support has been gained from government officials and the taxi owners and drivers because of the benefits of less expensive fuel and lower emissions. Opportunities for additional natural gas vehicles in Santiago continue to be explored by the Clean Cities participants there and prospects look good for expansion of the number of natural gas vehicles there. For example, an evaluation is underway now to determine what would need to be done to bring natural gas to the Santiago airport and to have the vehicles located at the airport use natural gas as fuel.

### **Safety and Maintenance Experience for Compressed Natural Gas (CNG) and Liquefied Natural Gas (LNG) Vehicles in the Developing World**

The use of CNG and LNG in transportation vehicles presents some unique hazards and risks, but they are mitigated through engineering design, and training of drivers, owners, and maintenance staff. The implementation of CNG and LNG in transportation vehicles in developing countries has proceeded without incident, as long as standards and codes are adhered to, and users are given the appropriate training. The only known problem to date has been in India where CNG cylinders built for use in vehicles were not made to international standards and created a risk of catastrophic failure due to material failure. While the desire to capitalize on new technology by building components in-country is understandable, it can derail implementation unless the proper procedures are followed, specifications are adhered to, and appropriate testing and quality assurance procedures are adopted.

### **Input from Representatives from USAID, Philippines Department of Energy, and Other Philippine Government Agencies**

Met first with Rosario “Chato” Calderon, Cecilia Dalupan, and Jose Dulce of USAID in Manila on April 15. Chato is the champion for Clean Cities in Manila and has been working hard to establish projects. She and her staff have identified several potential stakeholders and cities that are prime candidates to participate including the Philippines Department of Energy (PDOE), the Department of Environmental and Natural Resources - Environmental Management Bureau (DENR-EMB), Department of Science and Technology, the Philippine Coconut Authority (PCA), the Partnership for Clean Air (also PCA), Concerned Citizens Against Air Pollution (COCAP), the League of Cities of the Philippines (LDP), Ford Philippines, Department of Transportation and Communication - Land Transportation Office (DOTC-LTO), the Metropolitan Manila Development Administration (MMDA), the Intercity Bus Operators Association (INTERBOA), BP, GNPowder, and Caltex/Petron (the Philippine oil company). Several cities in the Philippines recognize the value of having clean transportation and making use of the relatively large natural gas resources that are just now being developed.

After discussing how Clean Cities operates with Chato and her staff, they came to the conclusion that the PDOE would be the most appropriate organization to head up Clean Cities in the Philippines. They have the staff to run the program and would serve as the primary contact with USDOE. It is anticipated that several Philippine Clean Cities would be coordinated by PDOE.

Met with Cyril C. Del Callar, Undersecretary of the Philippines Department of Energy and the Clean Cities Working Team. They see opportunities primarily to use natural gas as a transportation fuel, but are also working on biodiesel (coconut methyl ester, or CSE) and ethanol for blending with gasoline and diesel fuel. They are considering requiring CSE to be added to all diesel fuel at the level of 1%, ramping up to 5% eventually. The impetus for using CSE is primarily as a way to support coconut growers by assuring that coconut oil prices are kept sufficiently high to support growing coconuts. Their plans for ethanol are less clear, since there is only one ethanol producer now and production capacity appears to be limited (they did not have production figures available). They are also potentially interested in electric vehicles because the Philippines produces significant amounts of electricity from geothermal and wind energy, and they are promoting solar production of electricity as well.

Met with Joyceline A. Goco, Head, Interagency Committee on Climate Change Secretariat, Environmental Management Bureau. Joyceline is responsible for coordinating climate change projects in the Philippines, and her office represents the Philippines at the Kyoto Protocol. She is aware of the GHG benefits of alternative fuels, and supports their use in transportation vehicles. She expressed her willingness to support the PDOE to establish a Clean Cities Program and wants to assist in planning and critiquing projects, and measure the environmental benefits (reduced emissions and GHGs).

Gave an overview of the Clean Cities Program and International Clean Cities to the staff of the PDOE, and Hermelina Bion, Supervising Science Research Specialist, and Filomena Abarquez, Science Research Specialist, Department of Science and Technology (DOST), Fuels and Energy Division. Hermelina and Filomena are working on alternative fuels for industrial applications, and more efficient use of conventional fuels. They expressed their interest in supporting PDOE with alternative fuel projects.

Met with Ramon Santiago, Director, Anti-Smoke Belching Task Force, Metropolitan Manila Development Authority (MMDA). The MMDA is part of the Office of President Arroyo, and Ramon is pursuing several avenues to clean up buses and jeepneys<sup>2</sup> in Manila. The Anti-Smoke Belching Program identifies buses and jeepneys that are gross polluters through a smoke test, and penalizes them by taking their license plates until the vehicle is fixed, and imposing fines. (Based on my observations, they will have no problem finding vehicles to fine.) Ramon is also involved with the Green Vehicle Project. This is a voluntary program for bus and jeepney owners who certify that their vehicles are within the smoke standards by conducting regular preventative maintenance and/or by using clean fuels or emission control technology. The incentive for participation is that vehicles which are certified under the Green Vehicle Project get

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<sup>2</sup> Jeepneys were originally U.S. Army WWII jeeps converted to carry passengers. Today, jeepneys are special-built vehicles but the styling of the front end is a copy of the WWII jeeps. Another change is that all jeepneys now use diesel engines (used engines imported from other countries) while the original jeeps did not. All jeepneys are open-air, with passengers getting on and off from the back of the vehicle. The fare depends on how far you want to ride, but the minimum fare is 4 pesos which is about 8 cents U.S.

a sticker which makes them immune from road-side opacity tests unless they become gross smoke emitters again (the criterion for making this determination was not explained). Ramon was very supportive of a Clean Cities Program in the Philippines, and his close association with bus and jeepney owners would make MMDA a valuable participant. The value of his associations was made evident when he announced that one of the bus companies participating in the Green Vehicle Project (California Bus Lines) told him that they were planning to import 10 CNG buses! This was news to PDOE and USAID. He also said that the Governor Mandanas of the province of Batangas had submitted a proposal to implement CNG buses and jeepneys (Batangas is one of the provinces where natural gas is being produced in the Philippines). He also said that San Antonio was interested in implementing CNG vehicles (natural gas production is near San Antonio as well).

Met with Florencia Creus, Chief Transportation Regulation Officer, Department of Transportation and Land, Land Transportation Office (LTO). The LTO is responsible for licensing of all vehicles and drivers in the Philippines. She provided the latest vehicle statistics for the Philippines. There are just over 3.8 million vehicles in the Philippines (though Florencia acknowledged that not all vehicles are registered). Approximately 60% of all the vehicles in the Philippines are located in the Manila metro area. They classify their vehicles as follows:

- Cars
- Utility Vehicles (jeepneys are presumably included in this category)
- SUVs
- Trucks (all sizes, though most are similar to our Class 3, i.e., small delivery trucks)
- Buses
- Motorcycles/Tricycles (the tricycles are motorcycles with home-built sidecars for one or two people, though I saw as many as four hanging onto tricycles; the vast majority of the motorcycles and tricycles have 2-stroke engines, and are the major source of air emissions in cities outside of Manila where they represent a larger proportion of the total vehicles.)

Table 1 shows the breakdown of vehicles in the Philippines. Utility vehicles are the most numerous at 37.1% followed by motorcycles and tricycles at 34.8%. Cars are a distant third at 19.0%.

While only 29.9% of the vehicles are diesel powered, this is misleading because none of the

Table 1. Vehicles in the Philippines

	Gasoline	Diesel	Total	% Diesel	% of Total
Cars	711,665	17,685	729,350	2.4%	19.0%
Utility Vehs	596,828	829,052	1,425,880	58.1%	37.1%
SUVs	30,441	32,945	63,386	52.0%	1.6%
Trucks	13,414	240,182	253,596	94.7%	6.6%
Buses	1,208	30,478	31,686	96.2%	0.8%
MC/TC	1,338,263	0	1,338,263	0.0%	34.8%
Grand Total	2,691,819	1,150,342	3,842,161	29.9%	

motorcycles and tricycles are diesel. More telling is that 58.1% of all utility vehicles are diesel, and 52.0% of all SUVs are diesel (note: most of these SUVs are Japanese models not available in the U.S.; the only U.S. models observed were Ford Explorers and Expeditions). A growing number of the SUVs are being used for transportation - they are more popular than the jeepneys because most are air conditioned and they ride better (none of the jeepneys are air conditioned). Not surprisingly, 94.7% of the trucks and 96.2% of the buses are diesel powered. While jeepneys do not have their own category, all of them are diesel powered.

Florence approves of using alternative fuels, and is in support of Clean Cities, but she volunteered that anything that would raise the costs to the bus companies and jeepney owners would be vigorously opposed. Also, there is strong public support of tricycles because of the personalized service they offer (transport to a direct location, unlike buses or jeepneys).



Typical Traffic in Manila. A Haze of Smoke from Diesel Engines and Two-Strokes Engulfs the Lanes.



Using a Bandana to Filter the Air was a Common Sight



A Typical Jeepney in Manila



A Typical Bus in Manila Showing Significant Smoke During Acceleration





A Typical Tricycle in Manila



These Diesel Powered SUVs are Becoming Popular as Private Taxis



Philippines DOE has Converted a Diesel Bus to CNG. They appear to have done an excellent job, but it is unclear how extensively it could be replicated.



Propane is used in Manila for home cooking, and propane has been suggested for use in vehicles, though they now import it.



The Engine of the Converted PDOE Bus

## **Input from Private Sector Representatives and Identification of a Champion/lead Organization for the Clean Cities Manila Program**

Met with Gil-Fernando Cruz, Executive Director, League of Cities of the Philippines, and Bebet Gozun, Chair of the Partnership for Clean Air. Gil-Fernando explained how 13 Philippine cities are currently working together to promote projects to improve the environment. Projects are being conducted in 7 of these cities, focused primarily on commercial and industrial processes (e.g., fast-food restaurants, sugar mills, etc.). The 7 projects are scheduled to be completed by November 2002, and will become Clean Centers for replication by other cities. He understands very well that environmental projects require political support, and he is optimistic that the majors will support alternative fuel projects. He expressed much enthusiasm for Clean Cities in the Philippines, and was openly supportive of having PDOE take the lead role. He brought up the fact that outside of Manila, 3-wheelers are the primary emission problem because almost all of them have two-stroke engines.

Bebet Gozun has been working on improving air quality in the Philippines for over 10 years, and has participated in several U.N. and USAID projects. She is extremely well-informed about the issues, and was highly supportive of using alternative fuels in transportation. Her experience and drive is unique among those who we met with, and she could be a strong ally in implementing alternative fuel projects in the Philippines.

Met with J. Edmond (Jed) Garcia of GNPowder Company. GNPowder is building a new 1200 MW power plant using a combined cycle gas turbine fueled with LNG from Indonesia. The powerplant will be located in the province of Bataan and will include an LNG terminal. Storage capacity for the powerplant will be extensively oversized to allay lenders concerns about having a back-up fuel (usually oil). BP has been chosen as the LNG supplier, and they are encouraging use of LNG in vehicles (most likely as CNG) in addition to use for power generation. The oversize storage facility assures sufficient capacity for thousands of vehicles. The LNG facility is planned for completion in 2005, but its construction might be accelerated to completion in 2004. GNPowder is highly motivated to see that vehicles use natural gas from their facility.

Met with Mr. Willie Nava, President, Infinite Progressions Corporation. Willie Nava worked for Ford in the Philippines for over 10 years, and for several other companies. He currently provides training in preventative maintenance for fleets in Manila, and he understands the issues with implementing alternative fuels in the transport sector. He also recognizes the value of environmental improvements and is in favor of implementing alternative fuels in vehicles to reduce emissions. Mr. Nava and his company can provide important training and management consultant services to fleets and local governments in Manila.

Based on my observations, Bebet Gozun is the leading candidate to be the “champion” of Philippines Clean Cities. Supporting this observation is the fact that USAID provides funding to the PCA, which Bebet co-chairs with Ramon Santiago of the MMDA.

## **Coordination with NETL, DOE, USAID, and USAEP on Recommendations and next Steps**

The Philippines has all the ingredients needed to establish a Clean Cities: a lot of willing participants, commitment from high-ranking officials in the federal and local governments, support from fuel suppliers, support from several government agencies, agreement that implementing alternative fuels in transportation vehicles would be a good thing, and a realist, sound approach to project development. A Philippines Clean Cities would be a welcome addition to the list of International Clean Cities.

Based on my contacts and meetings in the Philippines, I believe the following are the next steps for Philippines Clean Cities:

1. Clean Cities Philippines needs to be formally launched, with all the pertinent stakeholders identified. A charter should be put together outlining the objectives of Philippines Clean Cities, and the responsibilities of the stakeholders. To be an International Clean Cities of the U.S. Clean Cities, a memorandum of understanding will need to be drawn up between the U.S. Department of Energy and the Philippines Clean Cities.
2. Clean Cities Philippines needs to nominate a coordinator - someone who will coordinate all the Clean Cities activities, keep all the stakeholders informed of Clean Cities meetings and activities, arrange periodic stakeholder and project meetings so that progress does not stagnate, and promote Clean Cities objectives and activities to the public. Successful coordinators are dynamic, persuasive, and committed to the objectives of Clean Cities.
3. Clean Cities Philippines should identify projects to pursue, including details such as what fleet, how many vehicles, the need for refueling facilities, need for training and technical assistance, and what promotional activities should be carried out in conjunction with each project.
4. For each project in #3, the benefits and costs should be estimated.
5. For each project in #3, strategies for implementation should be devised. These implementation strategies should include:
  - what vehicles will need to be acquired, or if conversions are desired, the engineering feasibility of the conversions must be completed.
  - provision for refueling the vehicles.
  - determination of the means by which any incremental costs will be paid for.

The only note of caution is the almost automatic assumption by most stakeholders in the Philippines that conversion of existing vehicles is the only cost-effective way to implement alternative fuel vehicles (AFVs). The vehicles of most interest to use alternative fuels are buses and jeepneys - both of these types of vehicles use old diesel engines. Conversion of some of these engines to use natural gas is likely feasible (as PDOE has shown), but many likely are not. Even for those engines that are feasible, the conversion route is fraught with potential problems. A safer, but less effective route would be to implement dual-fuel conversions where natural gas is introduced into the unmodified diesel engines to replace a portion (typically 30 to 50 percent) of the diesel fuel used. Emissions benefits are correspondingly decreased as well. Another

option might be to import used CNG buses from the U.S. or elsewhere.

For the gasoline vehicles in the Philippines, conversions are more feasible. But another option the Philippines should consider is importation of used AFVs from the U.S. The U.S. General Services Administration auctions off used AFVs each year, and Ford provides a service to place used Ford AFVs.

Since the Philippines does not have any natural gas pipelines, they should consider basing AFV refueling infrastructure on the LNG that will be imported from BP. By using LNG, refueling facilities will be less expensive, and will be able to be established much more quickly than having to rely on a pipeline system. Other advantages of relying on LNG are that the energy demands for producing CNG are much reduced, and fuel quality is very high.

## Appendix A - HIGHLIGHTS of PEP 2000 - 2009

### **Energy Demand and Supply Outlook**

Primary energy demand is projected to increase at an annual average rate of 6.3% from 256 million barrels of fuel oil equivalent in 2000 to 445 million in 2009.

Indigenous energy exploration and development will be intensified over the planning period to make the country increasingly energy self-reliant. Energy self-sufficiency level will increase from 42% in 2000 to 49% in 2004 due principally to the start of commercial production of natural gas and crude oil from Malampaya offshore field. Thereafter, self-reliance rate could decline if energy demand grows more rapidly than indigenous energy production.

To meet projected energy requirements, the Philippines will need investments of about P1.3 trillion (Philippines pesos) from 2000 to 2009, 90% of which is expected to come from the private sector. Structural reforms will be pursued and investment incentives enhanced to create an environment conducive to private sector participation.

The energy sector is accelerating completion of the "O Ilaw" rural electrification program to 2004, from the original target of 2008, as its direct and immediate contribution to the poverty eradication program of President Joseph Ejercito Estrada.

Government is promoting accelerated use and development of the more environment-friendly new and renewable energy sources.

Electricity demand will grow at an annual rate of 8.9% and will be supplied mainly by cheaper non-oil alternatives. The share of oil to total power generation is expected to shrink further from 10% in 2000 to 5% by 2009.

Demand for petroleum products is projected to grow at an annual rate of 6.4% from 129 million barrels in 2000 to 223 million barrels in 2009. The combined effects of an expanding economy, growing population and higher disposable incomes will provide the impetus for strong growth in energy demand.

Based on these, the country's primary energy use is projected to maintain a steady uptrend between 2000-2009 and to rise at an average annual rate of 6.3%.

Energy supplies will come from a diversified mix of energy sources, conventional as well as new and renewable energy (NRE). The Philippines is fortunate to have geothermal, hydro, coal, natural gas and NRE resources which presently supply 43% of total requirements. In addition, the Philippines are working on further enhancements of investment incentives for indigenous energy exploration and development. The Philippines are therefore confident that accelerated energy development activities and technological innovations will result in higher production

from their indigenous energy sources.

Nevertheless, indigenous energy production will not be able to match strong demand growth as energy consumption is projected to nearly double in the next ten years. The Philippines will therefore need to continue importations of oil and coal to augment local energy production.

Strategically, the Philippines are working towards energy self-reliance to ensure supply security and to minimize vulnerability to price fluctuations of imported energy. However, attaining 100% self-reliance may not be possible within the next ten years given the massive investments the Philippines will need and the constraints related to exploration and development activities such as the long gestation period of major energy projects, commercial viability of certain resources, and the resulting costs to energy consumers. As it is, the Philippines will need to quadruple indigenous energy production between 2000-2009 to become fully self-sufficient. Given these, it would not be realistic to expect the Philippines to be entirely self-sufficient for its energy requirements by 2009.